Luminescent porous materials for advanced optical applications

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Porous materials such as zeolites and porous silicon have applications in several sectors from biomedicine to energy and environment, with a direct and significant impact on our society [1]. Their porosity and high surface areas allow to capture contaminants from the environment, but also to incorporate multiple functionalities as multipurpose scaffolds for theranostics and other applications. By adding luminescent species, it is possible to design efficient probes which can be used as optical sensors or specifically tailored light emitting materials. In this presentation, I will describe our research in the field, with examples of Eu^{3+} or Ag multimers doped materials. The red emission of Eu^{3+} has a clear and identifiable spectral shape and a long luminescence lifetime, while Ag multimers provide an intense broadband emission. Both could potentially respond to the absorption and desorption of contaminant species or be used for optical imaging and lighting. Optimization of the synthesis process for 5A and 13X zeolites as well as porous silicon surfaces or nano/micro-particles, supported by a detailed structural and optical characterization will be presented, together with preliminary testing in heavy metal detection and lighting.

References

[1] A. G. Slater & A. I. Cooper, Science, Vol. 348, Issue 6238 (2015) DOI: 10.1126/science.aaa8075

Figures

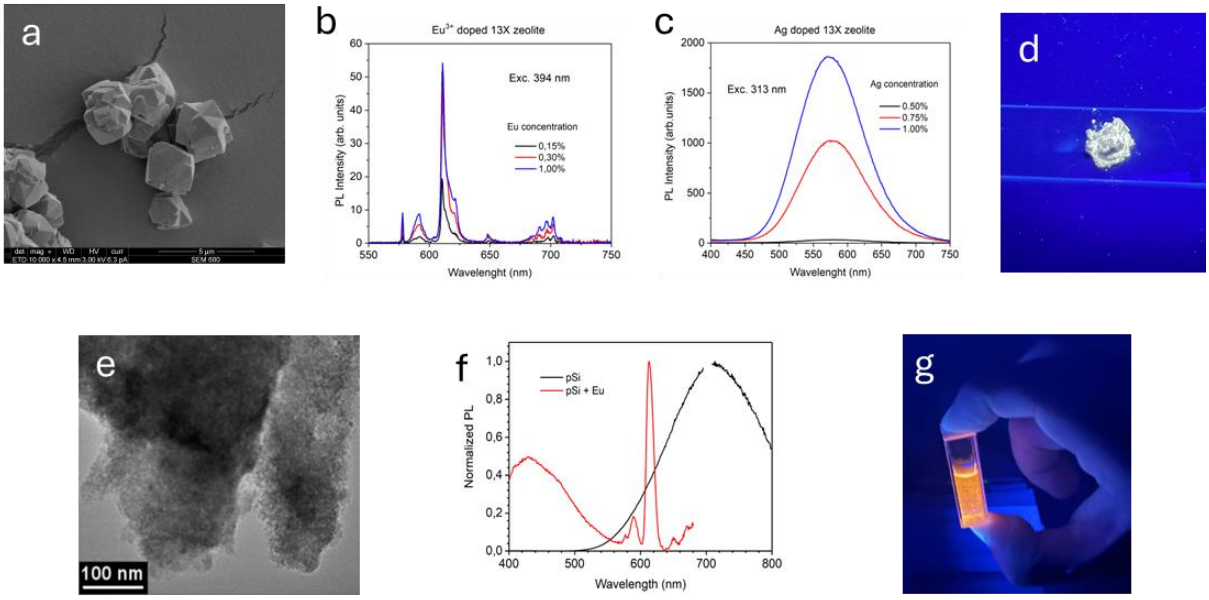

Figure 1: (a) SEM of 13X zeolite; (b) PL emission of Eu^{3+} doped 13X zeolite; (c) PL emission of Ag doped 13X zeolite; (d) UV excited Ag doped 13X powder; (d) TEM of pSi; (e) PL emission of pSi and Eu^{3+} doped pSi; (f) UV excited pSi in solution.